A two-stage model of policymaking with an empirical test in the U.S. energy-policy domain

Stokman, Frans N.; Bos, Jan M.M. van den

Published in:
The Political Consequences of Social Networks

A TWO-STAGE MODEL OF POLICYMAKING WITH AN EMPIRICAL TEST IN THE U.S. ENERGY-POLICY DOMAIN

Frans N. Stokman and Jan M.M. Van den Bos

ABSTRACT

Competing models of policymaking are integrated at a higher theoretical level into a two-stage model that distinguishes two different phases in the processes: the decision-taking phase and a prior phase in which significant actors interact to influence each other's policy positions. It is argued that these two phases are characterized by completely different power processes. The integrated two-stage model allows the positional power of all actors to be computed and the outcomes of policy processes to be predicted. To validate the model, the stepwise influence of the theoretically derived elements is tested in the U.S. energy-policy domain using data previously analyzed by Laumann and Knoke (1987). The model is shown to correctly predict six of the eight events analyzed. In addition, a quantitative contribution is made to the state autonomy debate.

Research in Politics and Society, Vol. 4, pages 219-253.

ISBN: 0-89232-994-7

INTRODUCTION

In recent years research on policymaking has shifted toward network analysis and the interaction between state and society in the formulation of collective decisions that shape policy. The necessity of analyzing the complex structure of actors, multilayered institutions, and networks of coordination and information exchange in order to understand modern politics has become generally acknowledged.

An important illustration of this shift in focus is Laumann and Knoke's *The Organizational State* (1987), an extensive empirical investigation into the role that organizations play in the policymaking process in two U.S. policy domains: health and energy. By specifying formal models that focus on the effect on decision making of the network of control relations among the organizations, they are able to predict the outcomes of events (Laumann, Knoke, and Kim 1987, henceforward LKK). Although their results seem to be impressive, we are not satisfied with the manner in which LKK specify their models. Their models blur the boundaries between the public and private sectors of society and do not distinguish between types of organizations nor between different stages in the decision-making process. In this paper, we present an alternative to the LKK models, a two-stage decision-making model that we test on the Laumann and Knoke energy data. Our results will be compared to those generated by their models.

THEORETICAL BACKGROUND

A number of recent articles have reopened the debate over the autonomy of the state from societal influences (Quadagno 1984, 1985; Orloff and Skocpol 1984; Skocpol and Amenta 1985). This debate concentrates on whether the state should simply be considered an instrument of societal action, in particular of ruling-class action, or whether state structures have their own impact on the outcomes of political processes.

"Political structures simply cannot be analyzed as autonomous entities but must be considered in terms of their underlying economic dimensions" (Quadagno 1984, p. 645). This "instrumentalist" position has been defended by both (Marxist) elitists and pluralists, although fundamental differences exist between these two approaches (Miliband 1969; Kolko 1962; Bachrach and Baratz 1970; Domhoff 1970, 1979, 1983; Dahl 1958, 1961).

In recent comparative political research, however, the emphasis has tended to be placed on domestic institutional structures and their historic evolution in the explanation of the difference between policy strategies of nations (Katzenstein 1978, 1985, 1987; Zysman 1983). The underlying assumption is that "social life is structured—not exclusively of course, but structured

nonetheless—by just those formal institutional mechanisms" (Katzenstein 1978, p. 19). These authors maintain that the institutional structure of a state imposes constraints on the actors concerned and thus "establishes the channels through which political fights flow" (Zysman 1983, p. 79). It is only when the institutional arrangements are taken into account that policy and economic outcomes can be ascribed to variations in the power of social groups (Zysman 1983, pp. 305-306). For this reason, this approach has become known as the institutionalist approach.

In corporatist studies, the differences in institutional arrangements between states depend on the extent and nature of the integration of private organizations in the decision-making process (Cawson 1985). A fully corporatized polity is described as a polity in which interest organizations have become strongly coopted into governmental decision making and implementation. In such a society, interest organizations are hierarchically structured and well-organized. Occupational categories are represented by noncompetitive organizations enjoying a monopoly position. As a consequence, industrial relations become characterized by a strong "concertation" of labor unions and employers' organizations with government (Lehmbruch 1982, pp. 5-6). In such a society, centralization and concentration in the organizational structure appear to be essential. When categorizing states according to corporatist content, Schmitter emphasizes two dimensions: first, whether the intermediation of interests takes place in a pluralist or corporatist manner, and second, whether the formulation of policy takes place through pressure-group activity or concertation (Schmitter 1982, p. 263).

In the late 1970s, these different views were amalgamated in the concept of policy networks (Hanf and Scharpf 1977; Heclo 1978; Katzenstein 1978). In an excellent review, Kenis and Schneider (1989, pp. 6-9) relate the introduction of the concept of policy networks to a variety of societal, conceptual, and methodological transformations, of which the most important societal ones are the emergence of the organizational society, the blurring of boundaries between the public and the private, and the sectoralization and consequent fragmentation of the state. The basic theoretical notion of policy networks is that policy outcomes are determined by mutual dependencies among societal and public actors:

> Policy networks typically deal with *policy problems* which involve complex political, economical and technical interdependencies, and therefore presuppose a significant amount of expertise and other specialized and dispersed policy resources. Policy networks are mechanisms of political resource mobilization in situations where the capacity for decision-making, program formulation and implementation is widely distributed among private and public actors (Kenis and Schneider 1989, p. 14).

To us, however, the policy-network concept is useful only if it provides tools to discriminate among different theoretical points of view. This requires elaboration of the more or less metaphorical policy-network concept into a

model of collective decision making. In order to be able to investigate the relative predominance of the different societal sectors in policymaking, such a model has to provide estimates of parameters in which the relative power of societal actors can be compared. Perhaps even more difficult, the model should make possible the comparison of these parameters to those of state bodies in order to estimate their relative autonomy in the system.

We commend LKK for stepping away from the metaphorical concept of policy networks and actually attempting to model policymaking. In the process of predicting the outcome of policy events, however, LKK strip policy-making of its institutional and procedural logic and focus exclusively on the contacts between organizations and the exchange of information/influence that occurs through these contacts. In doing so, we believe, they have completely negated the essence of political decision making, which is that relatively few actors are bestowed with the authority to make the actual decisions. The political process, we believe, should be conceived as consisting of two stages: a stage of final decision-taking by authorized actors, following a stage in which different policy positions are evaluated on the basis of more or less extended political consultations, exchange of information, and collection of expertise and other indispensable power resources. This two-stage process recurs at several moments in the collective decision-making process: in the phase of agenda setting (placing the demand on the political agenda), in the phase of more or less final decision taking, and in the phase of implementation. A complete policy-making process consists of a linked set of all such stages. It depends on the nature of the enquiry at hand whether the emphasis lies on the global process or on the different partial processes.

The two stages are characterized by two completely different types of power and influence processes (Mokken and Stokman 1976). In the stage of final decision-taking, authorized actors take a decision according to a voting rule. The relative power of these actors in that stage depends on the rule and the relative weights of the actors in the (voting) procedure. This type of power is therefore denoted *voting power.* In the stage prior to final decision-taking, however, power processes have a more dyadic character, in which the effectuation of an actor's power depends on his or her ability (and willingness) to determine the policy positions of actors with voting power. This ability, denoted *control,* requires (direct or indirect) *access* to actors with voting power and a significant amount of *power resources* that can be mobilized in such interactions. The willingness to do so—that is, to convert potential power into actually exercised power—is determined by the actor's interest in the decision to be taken, denoted *salience.* Of course, actors with voting power also have comparable abilities and willingnesses to influence the policy positions of other actors. Moreover, their ability to resist pressures for shifting policy positions depends on the relative size of their own power resources, and their willingness to resist depends on the salience of the decision for themselves.

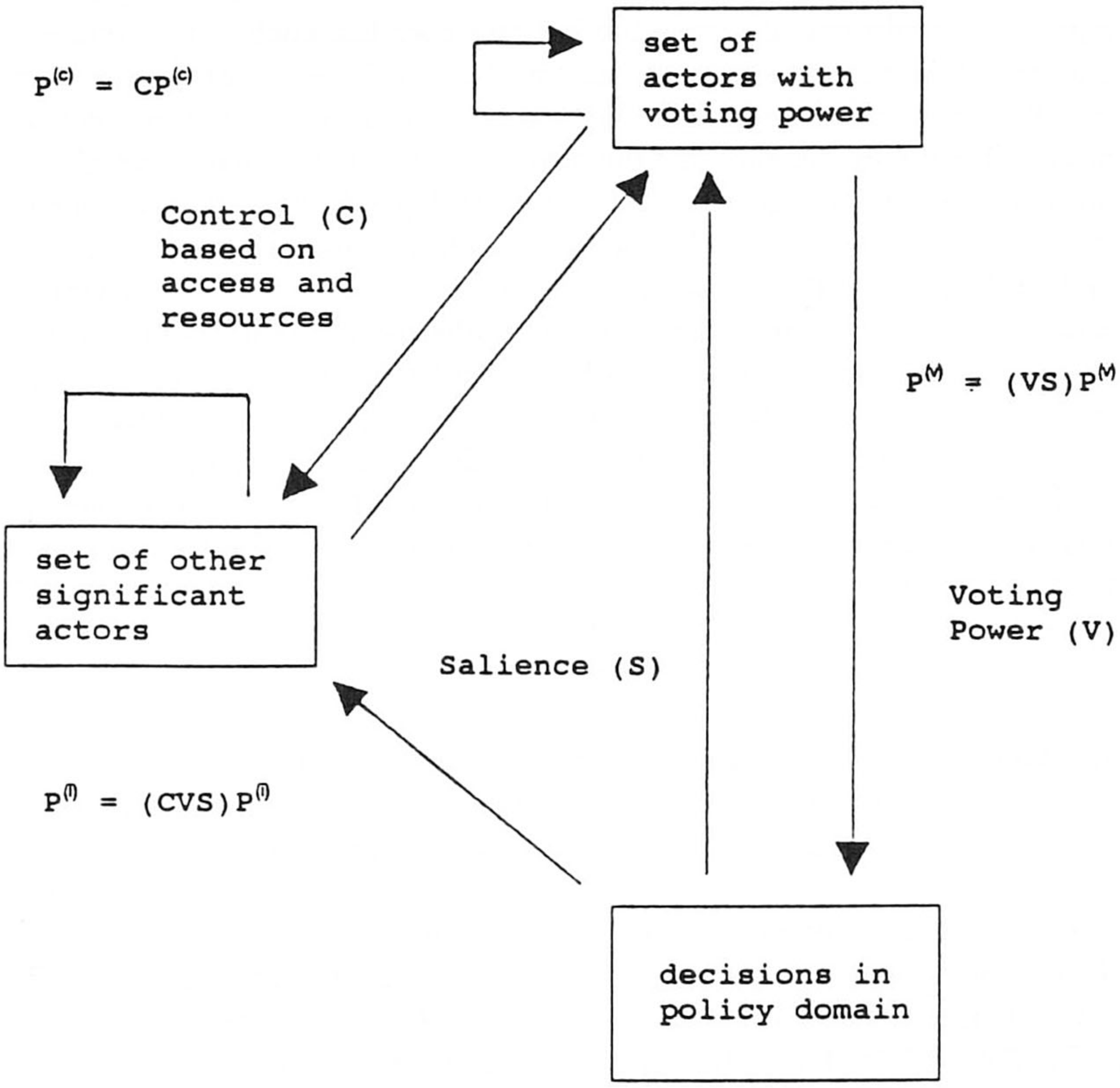

Figure 1. Figurative Representation of the Integrated Model

In the political sphere, actors with voting power are often denoted *public actors* and the others are *significant private actors.* Significant private actors can then be seen as interest groups and other societal groups that have well-defined interests in events within a policy domain. This relational system of actors and decisions is pictured in Figure 1. It also contains the equations of our two-stage model and the submodels on which it is based (to be explained later).

PREVIOUS MODELS

In the literature on models of the political process, two fundamentally different types were predominant during the last two decades. Each type is related to only one of the stages distinguished above. The first fundamental type is known as status or prominence models. We will refer to them as structural-network models, because in these models the power of actors in a system is based solely on their mutual dependencies. These mutual dependencies are not related to the outcomes of decisions. The theoretical interpretation of these models can be formulated in different ways. In some, actors are considered to be more powerful the more control they have over other powerful actors (see Hubbell 1965). In others, the power of an actor is determined by his or her direct and indirect control over other actors via all possible channels (sequences) in the network (see Katz 1953). A third interpretation focuses on the prominence of actors in the network (Bonacich 1972; Burt 1980). It has been shown, however, that these different interpretations are all in one way or the other related to the basic equation:

$$P^{(1)} = CP^{(1)} \tag{1}$$

in which: $P^{(1)}$ is a (N x 1) vector of powers of actors, and
C is a (N x N) matrix of (empirically given) control relations among actors (their mutual dependencies).

In a second class of models, referred to as social-exchange models, the mutual dependencies of actors are derived from a system of control of actors over events (e.g., decisions) that are of interest to other actors (see Coleman 1972, 1973, 1982, 1990). The power of an actor is defined as his or her amount of control over valued events; the value of an event is defined in terms of the interests of powerful actors in the event. Mutual dependencies among actors are therefore not given empirically, as in the structural-network models, but they are one of the outcomes of the model. Social-exchange models are in a way the mirror image of the former class of structural-network models: where the latter are based solely on the structure among the actors, completely independent of the set of decisions to be taken, the former are defined solely in terms of control and interest in decisions, but do not take into account the structure among actors.

The social-exchange model is given by two equations:

$$P^{(2)} = VW \tag{2}$$

$$W = SP^{(2)} \tag{3}$$

in which:

$P^{(2)}$ is a (N x 1) vector of positional powers of the N actors within the social exchange model;

V is the (N x K) control matrix of actors over events with entries v_{ik} (the symbol v is used because this type of control will later be defined as voting power in our own model);

W is a (K x 1) vector of the values of events; and

S is a (K x N) matrix of saliences of events for actors with entries s_{ki}.

When we substitute Equation (3) in Equation (2), the matrix of control relations (C in Equation 1) is obtained by the inner product of the matrices V and S, as can be seen in the following Equation[1]:

$$P^{(2)} = (VS)P^{(2)} \tag{4}$$

The importance of Coleman's contribution lies in his explanation of the way transitions between the individual level and the collective level take place in social systems. Behind the structures developed by Coleman lies a simple conceptual framework, of which the basic elements are actors and events. These elements are linked together: actors have control over events, and are interested in the outcome of events. Using this framework, Coleman shows how changes at the collective level stem from the exchange between actors of control over one event for control over other events. This exchange is due to the fact that actors have control over events in which they are less interested than other actors, and at the same time have little control over events that interest them intensely.

LKK (1987) present a model that can be seen as the first effort to integrate the two types of models described above, that is, to relate outcomes of decisions to a structure of mutual dependencies among actors. They have taken Coleman's model as their starting point but have changed it in various important ways. The most important change is that empirically defined dependence relations between actors are introduced in their models. In their own words:

> The model specifies a system of actors who are trying to control resources that belong to other actors and that are effective in controlling the outcomes of the events that have an impact on the first set of actors' own interests.
>
> Diagrammatically:
>
> control effective interests
>
> $\text{Actor}_i \longrightarrow \text{Actor}_{j\text{'s}} \longrightarrow \text{event}_k \longrightarrow \text{Actor}_i.$
>
> Resources
>
> (p. 370)

Although they state at a conceptual level exactly what we aim to model, regrettably they model something different. We can illustrate this on the basis of their Resource Mobilization Model, which differs from their Resource Deployment Model solely in the normalization of the C matrix of mutual control relations. Adapting their symbols to the ones used above, their Resource Mobilization Model is given by three equations.

The first equation represents the left arrow in their diagram:

$$P^{(3)} = CE \tag{5}$$

in which: $P^{(3)}$ is the (N x 1) power vector of actors,
C is the (N x N) control matrix of actors over actors as in Equation (1), and
E is a (N x 1) vector denoting the efficacious resources of actors in terms of a set of events.

In their own words, "The power of organization j is its control of efficacious resources owned by j" (LKK 1987, p. 370).

The second equation, representing the second arrow in their diagram, is:

$$E = VW \tag{6}$$

in which: E, V, and W are defined as in Equations (5) and (3).

In their own words, "The efficacy of resources owned by j is its effectiveness for controlling valuable events" (LKK 1987, p. 370).

The third equation, finally, represents the third arrow in their diagram:

$$W = SP^{(3)} \tag{7}$$

in which: S is the matrix of interests as given in Equation (3).

In their own words, "The value of an event is its interest for powerful actors" (LKK 1987, p. 370).

When we substitute Equations (6) and (7) in (5) we obtain the fundamental equation:

$$P^{(3)} = (CVS)P^{(3)} \tag{8}$$

which shows that the LKK model is of the same type as the first model, given in Equation (1). The big difference is that the matrix of mutual dependencies in LKK's model is not based solely on the structural-dependence relations, but also on the system of events under consideration. Stated in a nonmathematical way, the power of an actor in the system is now determined

by his or her control over actors who have control over decisions that are salient to powerful actors.

At this level of specification of the model, two major objections can be made against this set of equations. The first objection is that the values of events are determined solely by the interests of actors who have *control* over actors with efficacious resources (namely the vector $P^{(3)}$ in Equations (5) and (7)). In other words, the interests of actors with efficacious resources (the vector E), that is, the interests of actors with direct effectiveness for controlling valued events, do not directly contribute to the value of events unless they themselves have control over other efficacious actors. It seems reasonable to assume that direct effectiveness for controlling valued events is mainly located with *public* actors. Neglecting their interest in the determination of the values of the events amounts to an extremely instrumentalist view of the state.

The second objection is that direct effectiveness in controlling valued events does not contribute to the power of actors. Only direct control over such actors does, as Equation (5) shows. It seems more reasonable to determine the power of actors in terms of their direct effectiveness in controlling valued events plus their ability to control other actors with such abilities. Again, the specification of LKK implies a fundamental underestimation of public actors, whose powers in the above system depend solely on their control over other public actors and not on their own direct effectiveness!

Their approach becomes even more problematic in the estimation phase. Reasoning that matrix C gives the structural dependencies at equilibrium, they equate E with P, which implies that they determine the powers of actors solely on the basis of their structural dependencies, independent of the set of events and the interests of actors in these events. The two types of models described above are thus not integrated by LKK. On the contrary, the structural-network model of Equation (1) is first estimated and, subsequently, these estimates are used in the Coleman model of Equations (2)-(3) to estimate the elements v_{ik} in the matrix V. Consequently, their P vector is the vector $P^{(1)}$ of Equation (1), instead of the claimed vector $P^{(3)}$ of Equations (5) and (8).

On the basis of the assumption that actors in a system will direct their control to actors with efficacious resources, the elements of the matrix V are estimated as regression coefficients in equations in which the elements of C are the dependent variables and the interests of actors (weighted according to their power) the independent ones. This means that the effectiveness for controlling an event by an actor i is assumed to be greater when more powerful and/or interested actors direct control to actor i. Rightly, they themselves describe this estimation method as tautological (LKK 1987, p. 355).

A final objection concerns their definition of the matrix C. This matrix was obtained by asking informants to indicate with which other domain organizations their group engaged in a variety of transactions such as "giving confidential information," "giving substantial funds as payment for services

or goods," or "permitting other organizations to use its staff and facilities" (LKK 1987, p. 351). In their study a mix of eight power resources of actors were measured and used for other parts of their research. These resources, however, did not find a proper place in their power model. They simply were not taken into account. We shall see that we are able to incorporate them in our model in a theoretically meaningful way.

THE TWO-STAGE MODEL OF POLICYMAKING

The primary interest of social research and policy analysis lies not in describing in detail different aspects of the event itself, but rather in revealing the underlying mechanism that structures the event. In view of this different purpose, an approach must be applied that "imposes a simplified structure that grasps the essential elements of reality" (Bueno de Mesquita, Newman, and Rabushka 1985, p. 15). As we argued above, an essential element in policymaking processes is the presence of two stages, the stage in which a final decision is taken by entitled actors on the basis of a decision rule and the preparatory stage in which actors shape their own and others' policy positions in mutual contacts. Our two-stage model aims to model the structural and functional aspects of these two stages in one integrated model.

Structural Description of the Policymaking Process

Three submodels structure the two-stage model presented in Figure 1: the Voting-Power Submodel, the Control Submodel, and the Influence Submodel.

Voting Power and Salience: The Voting-Power Submodel

The voting-power submodel models the decision-taking phase. This submodel is directly based on Coleman's social-exchange model—see Equations (2)-(4)—but integrates it with a decision model that was proposed by Hoede and his collaborators (Hoede and Bakker 1982; Hoede and Meek 1983; Hoede and Redfern 1985) in order to obtain adequate estimates of the elements in the matrix V. The core of both models is lost through this integration, however, due to the fact that we model the functional, or dynamic, aspects of the models in a different way.

Hoede's model assumes that each decision maker has an inclination in favor or against a proposal. The actor's inclination need not be the same as his decision, due to influences from other actors with opposing opinions. The process in which the inclinations of the different decision makers are transformed into their ultimate decisions, and these in turn into a group decision according to a decision rule, is at the heart of the process of collective decision making (Hoede and Redfern 1985).

The voting power of an actor in our model is closely related to the definition of decisional power in Hoede and Bakker (1982). They define the *decisional power* of an actor as the proportion of collective decisions that is consistent with his or her inclination over all possible combinations of inclinations of the public actors. It depends on the decision rule (simple majority, qualified majority, or unanimity), the weights of the actors, and the control relations among the actors by which certain inclinations are converted to other preferences because of the existing control relations.

We deviate from Hoede and Bakker by modeling the conversion of certain inclinations via existing control relations to other preferences separately in the functional part of our model. Our definition of *voting power* is equivalent to that of decisional power in Hoede and Bakker when no control relations among actors are taken into account. We define the voting power of actors as the proportion of collective decisions that is consistent with the policy position of the actor over all possible combinations of policy positions of the actors who participate in the decision taking. It simply depends on the decision rule and the relative weights of the actors in the decision or voting procedure.[2] Coleman did not specify his interpretation of control over events in his social-exchange model. It seems reasonable to equate his concept of control over events with our concept of voting power.

The voting powers of the actors are specified in the matrix V (see Figure 1). If we have N actors and K collective decisions, the order of the matrix is (N x K) and its entries v_{ik} specify the voting power of actor i with respect to decision k. The model is given by the following equations, which differ from Equations (2) and (3) only in the estimation method for matrix V:

$$P^{(v)} = VW^{(v)} \tag{9}$$

$$W^{(v)} = SP^{(v)} \tag{10}$$

in which:

- $P^{(v)}$ is a (N x 1) vector of positional powers of the N actors within the voting-power submodel;
- V is the (N x K) voting-power matrix;
- $W^{(v)}$ is a (K x 1) vector of the values of decisions within the voting power submodel; and
- S is a (K x N) matrix in which s_{ki} denotes the interest of actor i in decision k or the salience of decision k for actor i. We added a superscript $^{(v)}$ to the vectors P and W, because we will later define comparable vectors in our overall model.

From these equations and a number of other assumptions, Coleman derives a state of equilibrium after exchange in which each actor has maximal control

over events in which he is particularly interested. We will not use this part of Coleman's model, because it is valid only for individual goods, whereas our primary interest lies in the field of collective goods, where not control over but policy positions on decisions are exchanged among actors. It is for this reason that we model the functional aspects of our model in a different way.

Our particular definition of the voting-power element makes it, for the first time, possible to represent the institutional settings as a separate element in models of the political process, independent of the more informal ways of control that actors exercise to influence the outcomes of decisions. When the research is focused on a single phase in a decision-making process, like a decision by an executive board, the voting powers of actors are determined by their weights and the decision rule in the board. However, when the research is related to more complicated decisions in which different executive and legislative or supervising boards are involved in the formal decision-making process, one single dimension is often insufficient for a proper representation of the institutional arrangements. To handle such situations, the voting-power measure has been extended to enable the specification of several dimensions in each of which a certain criterion has to be fulfilled simultaneously in order to arrive at a positive decision.[3]

Two examples may clarify the wide variety of institutional arrangements that can be representated in this way. First, the necessary simultaneous approval of a legislative measure by the White House and Congress can be represented in the voting-power index by the specification of three dimensions: one in which solely the White House has a positive weight with its own weight as decision criterion, and two for the House and the Senate respectively with either equal weights for each of its members or the number of seats for each of the parties with simple majority as decision criteria. The second example illustrates how institutional arrangements in corporatist systems can be represented. Typical of corporatist systems is the necessary simultaneous agreement of all social partners, represented in one body, and of the majority of parliament. This system can be represented by the specification of one dimension for the corporatist body in which the social partners have positive weights with unanimity as its decision rule, and of a second criterion in which the political parties are weighted by their number of seats with simple majority as decision rule. When relevant, a third criterion might be specified for the government if its consent is necessary for the implementation of the decision.

Actors, Access, Resources, and Control: The Control Submodel

Whereas the voting-power submodel pertains to the phase in which the actual decision is taken, the control submodel is altogether independent of the decisions taken. Our control submodel is equivalent to the class of models given in Equation (1), but includes a theoretically proper estimation procedure of

the elements of the matrix C, developed by Hoede (1978). Although the submodel is independent of the set of specific decisions, the specification of actors, resources, and access relations requires prior specification of the policy domain, as they are domain-specific in most empirical situations.

On the basis of an extensive examination of the different approaches of Katz (1953), Taylor (1969), Hubbell (1965), and French (1956), Hoede (1978) defined a power score for actors that eliminated the ambiguous elements in previous definitions. He defined status or power in terms of the combination of the relative predominance of power resources of an actor and his or her access to other actors of high status.

Let A be the adjacency matrix between the N actors in which $a_{ij} = 1$ if actor i has access to actor j, and $a_{ij} = 0$ if not. The amount of control of actor i on decisions taken by actor j depends on the power resources of actor i, defined by $r_{i,}$ related to the power resources of actor j and those of the other actors who have access to actor j. The elements of the control matrix C can therefore be defined by:

$$c_{ij} = \frac{r_i \cdot a_{ij}}{r_j + \sum_{\substack{k=1 \\ k \neq j}}^{N} r_k \cdot a_{kj}} \tag{11}$$

The equation also gives the amount of control of an actor over himself (c_{ii}), which is equal to one minus the incoming control of all other actors. For each actor, the sum of all his incoming control and the control of the actor over himself sums to one.

On the basis of this control matrix (C), Hoede defines the power of actors as the total amount of control actors can directly or indirectly exercise over other actors. He shows that this is equivalent to the sum of, on the one hand, the total amount of control actors can exercise directly over other actors and, on the other hand, this amount weighted by the positional powers of other actors (for a summary, see Sprenger and Stokman 1989).

Connecting Voting Power and Control: The Influence Submodel

In the control submodel, the positional power of actors was derived on the basis of access and resources, independent of the decisions to be taken. In the voting-power submodel, positional power was modeled on the basis of the voting power of the actors over decisions of interest to powerful actors, independent of the access and resources of actors to each other's decision-

making centers. The influence submodel derives the indirect influence of actors on decision making in the phase prior to the final decision-taking by integrating the two submodels. This can be done by redefining the elements of the models applied in *The Organizational State* (LKK 1987) according to the definitions given above.

When we define control as in the control submodel, and actor *j*'s resources effective over event *k* as actor *j*'s voting power, the LKK line of reasoning amounts to the equation:

$$P^{(i)} = CVSP^{(i)} \tag{12}$$

in which: $P^{(i)}$ is a (N x 1) vector of positional powers of the N actors within the influence submodel, and
C, V, and S are matrices as defined in Equations (9)-(11).

Integrating the Influence and Voting-Power Submodels: The Two-stage Policymaking Model

The voting-power submodel enabled us to estimate the positional powers of the actors on the basis of their voting power in the final decision-taking over decisions of importance to other powerful actors. The influence submodel did the same on the basis of actor's indirect control over other actors with voting power over decisions of importance to other actors in the phase prior to final decision-taking. These two submodels can be integrated into one overall power model over the two phases of the policy process by defining positional power as the combination of control over actors with voting power over valued decisions and/or the actual voting power over valued decisions itself. The value of decisions is again defined in terms of their salience to powerful actors. The equations of the overall model are:

$$P = (CV + V)W \tag{13}$$

$$W = SP \tag{14}$$

Substituting (14) in (13), the Overall Power Model can also be defined as:

$$P = (CVS + VS)P \tag{15}$$

or as:

$$P = (CV + V)SP \tag{15a}$$

Given C, V, and S, the vectors P and W can be estimated.[4] The empirical specifications of V reflect the institutional differences between political systems in formal decision-making procedures, whereas those of C reflect institutional differences in access and control among societal and public actors.

Let us look more closely at $(CV + V)$. The additivity of CV and V can be argued by the fact that V gives the voting power of an actor over an event, whereas CV gives his or her indirect impact on the event via his or her control over actors with voting power. This reflects our critique on LKK, who took only the indirect impact of actors into account (see Equation (8)). The overall impact of an actor is given, however, by his *direct* impact on valued decisions *plus* his *indirect* impact via his control over other actors. The overall impact of the actor on the event is therefore obtained by adding these two components.

However, specifying overall impact of an actor on an event as $(CV + V)$ assumes that only direct-control relations among actors are used and that no control is exercised over longer chains of control relations. This seems unrealistic, particularly in more extended policy processes that are debated over a longer period of time. In such cases, it might be desirable to include such indirect control in the model. One elegant way of doing this will be specified in the functional specification of the model by simulating different influence rounds among the actors, acting in the next round with their newly obtained positions with respect to the events. Another equally elegant way, however, is to change the basic Equations (13) and (15a) in such a way that indirect control is taken into account. From the literature on structural network models it is well known that under proper normalization of C the matrix $(I - C)^{-1}$ specifies all control among actors over all possible sequences in a network. Replacement of C by $(I - C)^{-1}$ in Equations (13)-(15a) is the second method of including indirect-control relations among actors.

It should be noted that the vector P in Equation (15a) is indeed a different power vector from the previous P vectors, which were based on only one or two elements (see, e.g., our critique of the LKK estimation procedure). Vector P explicitly combines *four essential aspects of power* into one overall estimate: (1) *access* to other actors, public as well as private; (2) availability of *resources* to effectuate control over other actors and to determine their final policy positions; (3) *voting power* of public actors over decisions; and (4) *salience* of these decisions for powerful actors. In our empirical application, we will also investigate the contribution of each of these elements to the prediction of the outcomes of decisions.

Functional Description of the Policymaking Process

Equations (13)-(15a) and the equations for the separate submodels contain the structural descriptions of the policymaking model. As such, they give a static picture of the policymaking process. The dynamic aspects are contained

in the functional description, in which the outcomes of the process are modeled, such as the conversion of policy positions of actors due to influence processes in the influence submodel, the prediction of outcomes of decisions, tendencies of structural changes in the system, and so on. Given the present state of development, we specify only the first two.

Coleman's major contribution lies in his specification of the micro-macro link in the social-exchange model, in which the basic mechanism of the dynamics of the system lies in the exchange of control among actors according to their interests. This assumption is only valid when we deal with divisible goods for which the preference of actors is a nondecreasing function (the more the better). However, our model is primarily focused on collective decisions for which actors have a single peaked preference function, indicated by their policy position with respect to the decision. We believe that the dynamics in such political processes are primarily located in a sophisticated weighting of policy positions of significant actors in the determination of a public actor's final policy stand. Referring to Poulantzas (1978, pp. 132-135), Quadagno formulated our position as follows:

> The state, then, is not a unified mechanism founded on a hierarchical distribution of power, but rather a mediating body that weights priorities, filters information given and, because of its autonomy from any given class or faction, integrates contradictory measures into state policy (Quadagno 1984, p. 634).

The stage prior to the final decision-taking can therefore be seen as the stage in which final policy positions are shaped through processes of mutual access. In this process, the control relations in the control submodel determine the abilities to induce changes in policy positions of other actors if they deviate from an actor's own policy position, while the salience of the decision determines the willingness to put such abilities into effect.

If we assume that the influence processes in the influence submodel take place simultaneously, the policy position of an actor at time $(t + 1)$ can be seen as a weighted sum of his own policy position and that of other actors at time t. The weights are determined by his own and incoming control relations, as defined in Equation (11), and the saliences of the decision for the actors. At time $(t + 1)$ the policy position of actor i on decision k, denoted $x_{ik}^{(t+1)}$, is given by:

$$x_{ik}^{(t+1)} = \frac{\sum_{j=1}^{N} s_{jk} \cdot x_{jk}^{(t)} \cdot c_{ji}}{\sum_{j=1}^{N} s_{jk} \cdot c_{ji}} \qquad (16)$$

As Equation (16) shows, the policy positions of all actors are changed in the phase prior to decision-taking. These changes are independent of the voting powers of actors over decisions. The latter, however, transform the shaped positions of public actors to outcomes of the decisions. In our model, these are predicted by taking the weighted sum of the policy positions of public actors after a number of influence rounds. The predicted outcomes of a decision k at time t, $o_k^{(t)}$, is given by:

$$o_k^{(t)} = \frac{\sum_{i=1}^{N} x_{ik}^{(t)} \cdot v_{ik}}{\sum_{i=1}^{N} v_{ik}} \qquad (17)$$

It assumes that the opinion of minorities are also taken into account, but weighted according to their voting power.

AN EMPIRICAL TEST

The only straight-forward test of the accuracy of our two-stage model is the ability of the complete model to predict the outcome of concrete events. For our first empirical test, we turn to data on United States energy policy, which were made available by Laumann and Knoke. Their project culminated in *The Organizational State* (1987) and involved in-depth research on the role of organizations in policymaking.

Laumann and Knoke define the dependence relations among actors empirically. Executive directors, vice presidents for government affairs, or senior staff specialists of the 198 most significant organizations in the energy domain were extensively interviewed concerning the role of their organizations in important governmental decisions in the energy field during the Nixon, Ford, and Carter administrations (with emphasis on the Carter years).

The interviewed organizations were classified as: 20 Congressional subcommittees (CS); 21 federal agencies (FA); 9 associations of state and local governments (GA); 4 research units (RU); 5 labor unions (LU); 48 trade associations (TA); 2 professional societies (PS); 66 business corporations (BC); and 23 public interest groups (PI).

To select events, LKK (p. 351) first carried out a hierarchical clustering analysis based on a matrix of similarities of participation by organizations in the 81 events for which data were collected. If two events attracted the same set of participants, the distance between the two events is zero. In order to

represent the entire policy domain as best as possible, LKK selected eight controversial events that were evenly distributed in the denodogram of the whole policy domain produced by the clustering technique. The decisions are:

EV107: The House Science Committee refuses for a third time to halt construction of the Clinch River breeder reactor (April 1979);
EV109: The Senate Energy Committee reports a bill to store nuclear wastes in above ground vaults for up to 100 years (December 1979);
EV214: Two House committees report bills to create an Energy Mobilization Board to expedite energy development projects (August 1979);
EV323: House-Senate conferees sign a report on a compromise natural-gas deregulation bill calling for a phase-out of controls by 1985 (August 1978);
EV326: The House Interior Subcommittee votes for a six-month nuclear power plant construction moratorium (May 1979);
EV328: The House Ways and Means Committee reports a bill to tax windfall profits on deregulated oil and gas (June 1979);
EV329: The Senate Energy Committee reports a bill to allow states to design their own coal strip mining control plans without adhering to the 1977 federal act (July 1979); and
EV412: The House Commerce Committee reports Carter's first proposed standby gasoline rationing plan (April 1979).

Measurement

To compute the positional power of the actors, we need to have the contents of the *C, V,* and *S* matrices, which requires data on the access of the actors to each other, their individual power resources, the voting power these actors had in the collective decisions taken in the field, and the salience of the decisions for the individual actors. In order to predict policy outcomes, information regarding the policy positions of the various actors is also required. Due to the fact that Laumann and Knoke only gathered policy positions for organizations that were particularly interested in the specific decision at hand, the number of organizations with a policy position for the decision ranges from only 20 to 60 percent. Regretfully, this means that we have to restrict our analysis in each individual decision to those actors that indicated a position.

As shown in Equation (11), control can be computed when data is available on access and resources. To operationalize *access,* the interviewed organizational representatives were asked to list all the organizations with which especially sensitive problems in the national energy field were discussed prior to the determination of the policy position of either the own organization, or the other organization. Operationalized as such, we feel that our data adequately reveals those channels through which control over other actors is exerted.

Laumann and Knoke also asked the respondents to list the *resources* of the five to ten other organizations they knew best on which that organization's influence is based. They could list eight types of resources: special expert knowledge in the field; funds to secure support for proposals; staff or facilities to gather support; official decision-making authority; good connections with influential organizations; a reputation as an impartial mediator; ability to mobilize its members; and/or ability to mobilize public opinion.

Our operationalization of resources is based upon the scores of six of these eight types.[5] For each resource type, each organization received a score based on a quintile distribution, that is, if an organization had been mentioned sufficiently often to be in the top 20 percent of organizations, it received a score of four. If an organization was not mentioned, it received a score of zero. The scores on the six selected resource types were subsequently averaged to produce an estimate of overall resources. Since the number of organizations that were not mentioned was larger than 20 percent for each of the six types of resources, those organizations with an overall score of zero had not been mentioned at all by the executives interviewed. Of these organizations, we have no information whatsoever regarding their resource base. Acting on Laumann and Knoke's assumption that important organizations will have been mentioned by at least one of the executives interviewed, we believe that the control of these organizations over other organizations is indeed negligible. Thus, our operationalization of resources results in a score ranging from zero to four.

Our operationalization of resources is not without problems. Notwithstanding the intricacies of our operationalization, we feel that Laumann and Knoke have mixed elements of access into their data on resources. The respondents were only asked to indicate the resources of the organizations they knew best. In addition, due to the great difference in the number of organizations in the various organization types, and the large frequency of mutual contacts within certain types, it is virtually inevitable that the resources of certain organizations have been exaggerated.

With regard to *voting power*—the model component completely absent in the LKK approach—the eight selected decisions by Congress can be regarded at at least two different levels: first, as decisions taken by Congressional (sub)committees—in this context, only our Congressional actors would receive voting power—and, second, as decisions that represent the overall political process. LKK analyze these decisions only at the latter level. In doing so, they interpret these decisions in terms of event scenarios and evaluate their predictions in terms of the outcomes of the entire process. This is shown in the Appendix, in which LKK's event scenarios are reproduced.

Interpreted in terms of the overall policy process, all public actors who contributed to the final outcome by taking intermediate decisions are given voting power. These public actors can be divided into three categories: (1) the White House, which holds a key role in the legislative process; (2) the

Congressional actors directly involved; and (3) the federal agencies that participate in the formulation of proposals and implementation of policy. At the level of the complete policymaking process, these three categories of actors must reach agreement in order to obtain a positive outcome. Otherwise, barriers are raised that prevent the adoption of policy initiatives. In accordance with our model of voting power, three dimensions were defined. In the first dimension, only the White House was given a weight of one and this weight was specified as decision criterion. In the second dimension, the Congressional actors were given a weight factor. The LKK data contained solely (sub)committees, split according to party, as actors. For the (sub)committees that were engaged in the decision, the size of the party representation in the (sub)committee was used as weight factor and simple majority as decision criterion. For one decision, Tax Windfall Profits (TWP), none of the concerned Congressional (sub)committees were represented in the data. For this decision, no Congressional dimension was specified. In the third dimension, federal agencies responsible for the formulation and/or implementation of the decision were given an equal weight of one. Assuming that formulation and implementation required the consent of at least one agency, one was specified as decision criterion. After computation of the voting powers, they were converted from the [.5,1] interval to the [0,1].

For the predictions of the outcomes of the decisions, we investigate the three dimensions separately: the directions of the opinions for the White House, for the majority of the concerned Congressional (sub)committees, and for the federal agencies. When these directions are the same for the three dimensions after a certain number of influence rounds, that direction is taken as the prediction of the outcome. As stated earlier, influence rounds can be simulated by having the actors act—in the new round—on the basis of their newly obtained positions with respect to the event. The prediction is considered stable when the directions remain the same in higher influence rounds.

During the interviews conducted by Laumann and Knoke, the *salience* of the events for the participating organizations was measured in a straightforward fashion. The respondents were asked to indicate those issues during the past four to five years in which their organization had an interest, and to indicate the level of interest. We use these data without translation.

Finally, we would like to stress the fact that the positional power computed by the model for the actors in the subsystem is only based upon the analyzed events (in our case, only eight discrete events). Our analysis is based on a closed model. Therefore, it is of the utmost importance to include in the analysis events that represent the policy domain as a whole. In the present case, the events have been clustered according to similarity in participation. Given that the events were taken from different issue areas, evenly distributed across the entire policy domain, we consider these conditions met.

Results

In Table 1 we report our predictions for the outcomes of the eight selected events. For the first event, the appropriation of funds for the Clinch River Nuclear Breeder reactor (CRNB), our model predicts the continuation of funding for the breeder reactor, in spite of massive initial resistance from the executive branch. Already, after one influence round, the White House is shown as shifting from a negative to a positive position. From that moment on, the three groups of public actors (White House, Congress, and federal agencies) are shown as remaining in agreement when more influence rounds are simulated. Our prediction is therefore stable.

In reality, the full House rejected the Carter proposal to terminate the demonstration project (182-237), although the Senate Energy Committee agreed to the proposal. An authorization of funds as proposed by the Carter administration, therefore, did not pass Congress, "thus leaving in place the original language authorizing work on the project" (Congressional Quarterly 1981, p. 523). Our positive prediction seems to indicate an unwavering opposition to the administration's attempts to kill the demonstration project, which is in concurrence with the actual outcomes of the various confrontations between the Carter administration and Congress.

For the Nuclear Waste Storage (NWS), our model again predicts a positive outcome after the first influence round, a prediction that remains stable in higher influence rounds. This positive decision is in line with the wishes of the Senate Energy Committee to find an interim solution to this environmental problem.

The marginally positive predicted position for the Congressional actors after the first influence round can be seen as a more than adequate estimation of the actual process of decision making that took place in this event scenario. The bill that the House accepted was in reality radically different from the Senate measure. As little time was left to find a compromise in conference, the key members of the respective concerned Congressional committees decided to defer further recommendation until the following Congress. At the initiative of Butler Derrick, the Republican Senator from South Carolina, a last-minute provision was, however, approved that made the disposal of commercial low-level nuclear waste a state responsibility (Congressional Quarterly 1981, p. 524). Although not a very substantial measure, we interpret this final outcome to be in accordance with the environmental protagonist wishes.

Our model wrongly predicts a positive outcome on the creation of an Energy Mobilization Board (EMB) to speed high-priority energy projects through legal and bureaucratic red tape (for which the House committee reports of August 1979 can be seen as one of the first steps in the process). Successive rounds of influencing do not bear any favorable change in the predicted outcome—on the contrary. As we shall see below, even when analyzing the contribution

Table 1. Predicted Positions Based on Original Positions, Predicted Positions After Influence Rounds, and Predicted Outcomes of Eight Selected Events in the U.S. Energy-Policy Domain

	Original Position	*Position after Influence of Round*			*Actual Outcomes*
		One	*Two*	*Three*	
Predicted Positions for the White House					
CRBR	-1	.16	.06	.12	+
NWS	-1	.13	.04	.09	+
EMB	1	.26	.43	.39	−
NGD	1	.15	.27	.24	+
NPCM	-1	-.52	-.58	-.56	−
TWP	-1	.18	.04	.10	+
SMCP	-1	-.01	.05	.07	−
SGRP	-1	.05	-.22	-.13	−
Predicted Positions for Congress					
CRBR	1	.17	.18	.16	+
NWS	1	.05	.09	.10	+
EMB	1	.33	.39	.40	−
NGD	1	.28	.27	.25	+
NPCM	1	-.37	-.45	-.52	−
TWP	*	*	*	*	+
SMCP	1	.02	.06	.07	−
SGRP	-1	-.14	-.23	-.16	−
Predicted Positions on the Basis of Shared Opinions of White House and Congress and at Least One Concerned Federal Agency					
CRBR		+	+	+	+
NWS		+	+	+	+
EMB		+	+	+	−
NGD		+	+	+	+
NPCM		−	−	−	−
TWP		+	+	+	+
SMCP			+	+	−
SGRP			−	−	−

of the individual model components in predicting the outcome, we are never able to correctly predict this event. Our model consistently predicts a positive outcome—that is, the formation of an Energy Mobilization Board—and furthermore, by a substantial margin.

Legislation that would create an Energy Mobilization Board was passed by both the House and the Senate in 1979. The final version was reported by conference in June 1980. On June 27, an "unusual coalition of states' rights House Republicans and liberal Democrats [who objected to the envisaged

power of the board to override environmental laws]" (Congressional Quarterly 1981, p. 518) defeated the bill and sent it back to conference, where it was to be rewritten with state and local laws upheld. There the proposed legislation died with the expiration of the term of the 96th Congress a year later. The final outcome of this event is, therefore, negative.

Our model fails to predict the right outcome because of the successful effort of conservative Republicans and liberal Democrats, with the support of environment protection groups, to shift the issue from the energy-policy domain to the domain of state and local autonomy. A correct prediction would have required the representation of the significant actors and their mutual relations in that domain, which is not available in the data. Laumann and Knoke represented the party factions of Congressional subcommittees as organizational entities in their analysis, similar to business corporations and interest organizations. Issues of state and local autonomy, however, cross party lines completely which makes this assumption unrealistic. The questionability of this assumption is also reflected in research in the field. Recent literature has tended to focus on personal characteristics of the participating Congressmen when analyzing congressional decision making (Hall 1987).

Our model predicts a decisive positive outcome on the Natural Gas Deregulation (NGD) issue. We expect that our prediction will be an even more reliable estimation of the final outcome than in other cases. Organizations have had ample possibilities to reflect on the matter, whereas the event for which data was received pertains to the final Congressional decision regarding the whole event scenario. The outcome we predict varies little after successive influence rounds and is consistently correct.

The scores we predict are in accordance with the actual outcomes in the conference committee (23-19) and later in the House (231-168) and in the Senate (57-42) (Congressional Quarterly 1981, p. 480). Almost all public actors were aware of the need for deregulating the price of natural gas in the light of the Iranian oil crisis. The extent to which prices should be deregulated was, however, one of the key controversial aspects of this event. This together with "intense lobbying from industry and other interest groups, chipped away at Carter's plan" (Congressional Quarterly 1981, p. 468).

Even more decisive are the predictions of our model on the Nuclear Plant Construction Moratorium (NPCM) issue. The two-stage model arrives constantly at an extremely strong negative outcome. Once again, this predicted outcome is a good reflection of the actual outcome. Shortly after the nuclear power plant accident at Three Mile Island, the House Subcommittee on Energy and Environment passed an amendment to the Nuclear Regulatory Commission authorization bill for 1980, calling for a six-month moratorium on nuclear power plant construction. The full House, however, rejected the amendment with "a wide enough margin [135-254] to discourage James Weaver, D-Ore., from offering an amendment, as he had planned, to prohibit

the NRC from issuing operating licenses to new reactors in states without approved emergency plans" (Congressional Quarterly 1981, p. 520).

Regarding the issue of the Tax on Windfall Profits of deregulated gas and oil (TWP), a few additional remarks on the LKK data should be made. In contrast to all other analyzed events, not one of the Congressional actors interviewed was awarded voting power for this decision. The party factions of the House Ways and Means Committee, or subcommittees thereof, were not interviewed. Therefore, only two dimensions of voting power are relevant: that of the White House and that of the federal agencies. The fact that even after continued influencing, our model results remain only slightly positive, points to a controversial issue, although the model repeatedly envisages the adoption of a tax.

In reality, the Ways and Means Committee passed in 1979 a bill that proposed "shifting the burden of the tax bite to place more of it on oil already being produced and less on newly discovered oil" (Congressional Quarterly 1981, p. 506). At a later moment in the process, the amended version of the Ways and Means Committee was tossed out by the House and replaced by a substitute "which the industry found far more palatable than the committee bill" (Congressional Quarterly 1981, p. 506). In this version, the tax would be only temporary. Carter appealed to the Senate for a tougher tax bill, which in fact was reported and adopted by the Senate. In March 1980, the conference committee reached an acceptable compromise. On March 27, the bill had passed both chambers—House: 302-107 and Senate: 66-31. Six days later, Carter signed the measure. Our predicted outcome can therefore be seen to approximate the original Congressional difference of opinion.

For the Strip Mining Control Plans (SMCP), two influence rounds are necessary before the three dimensions of White House, Congress, and federal agencies result in a unanimous prediction. This prediction is then slightly positive and remains so in later influence rounds, that is, that the proposed bill by the Senate Energy Committee will be endorsed and become law. This is at odds with the facts. As stated in the Appendix, the Senate Energy Committee bill was allowed to die in the House and later in conference.

When the policymaking process is examined from a broader perspective that includes the implementation phase in the analysis—see the earlier theoretical section—another interpretation seems possible. In 1980, the Supreme Court agreed to hear cases challenging the Surface Mining Control and Reclamation Act of 1977. If the Supreme Court rulings are considered to be final outcomes of national policymaking, our positive prediction could be explained. Furthermore, this could explain Laumann, Knoke, and Kim's description of the actual outcome in *The Organizational State* as being positive. In any case, the very small magnitude of our predicted margins is in accordance with the actual process of decision making.

For the last of the eight selected events, the Standby Gasoline Rationing Plan (SGRP), our two-stage model needed again two influence rounds to forecast an outcome, negative this time, thereby implying the rejection of the plan. Once again, this is the correct prediction of the final outcome.

The data we received, as well as the two influence rounds required for our predictions, reflect the generally skeptical feeling of all organizations awarded decision-taking authority. An existing public law required the submission of gasoline rationing plans by June 1976. Only as a consequence of the Iranian oil crisis did the Carter administration submit a proposal in April 1979. The House Commerce Committee rejected the plan twice, voting the second time to send it to the full House without a recommendation. The Senate, however, did approve the plan, although the Senate bill amended the original proposal greatly, explaining the negative original position of the White House in the data. On the floor of the House, the SGRP was doomed from the beginning; on May 10, the House rejected it by a wide margin—159-246. This rejection illustrates "the difficulty of persuading politicians to approve laws that would force voters to change their energy consumption habits" (Congressional Quarterly 1981, p. 496).

In summary, our two-stage model has been correct in predicting the final outcome in six or seven of the eight selected cases, depending on what is taken to be the final outcome of SMCP. Only in the case of the Energy Mobilization Board did the two-stage model predict the final outcome incorrectly. In this case, however, Congress behaved in a way that cannot be brought into accordance with the manner in which it has been modeled because of the shift of the issue to the policy domain of state and local autonomy. As a consequence, we do not see this result as a serious refutation of our model.

We faced the difficult task of challenging LKK's score of correctly predicting the final outcome of six of the eight events.[6] The two models arrive at exactly the same predictions. We consider this as favorable for our model because our model represents the institutional settings of the decision-making process explicitly, implying that the final prediction is based on only the policy positions of the few public actors with voting power after the influence stage; the predictions of LKK, however, are based on a weighted average of all actors after a complicated and theoretically questionable estimation of their policy positions.

We now turn to the contribution of the components in our model to the prediction. In Table 2, voting power is eliminated and the predictions of outcomes are solely based on combinations of the other three components of our model. In these models, the outcome of a decision is predicted as the average position of all actors for whom a position was indicated in the data base.

A first inspection of Table 2 leads to the observation that access alone is sufficient to arrive at the final predictions. When control among actors is based

Table 2. Predicted Outcome of Eight Selected Events in the U.S. Energy-Policy Domain After Addition of Consecutive Components

	(*1*) *A*	(*2*) *A* * *S*	(*3*) *A* * *R*	(*4*) *A* * *R* * *S*
CBR	0.120*	0.145*	-0.164	-0.141
NWS	0.239*	0.209*	-0.054	-0.115
EMB	0.413	0.450	0.446	0.481
NGD	0.356*	0.354*	0.330*	0.344*
NPCM	-0.630*	-0.618*	-0.593*	-0.580*
TWP	0.066*	0.072*	-0.082	-0.067
SMCP	0.263	0.240	0.078	0.023
SGRP	-0.231*	-0.295*	-0.302*	-0.335*
Number correctly predicted	6	6	3	3

Notes: * Denotes a correct prediction.
** Based on the average position of all actors with an original position.

not solely on access but also on resources of actors, the model deteriorates sharply and predicts only three of the eight events correctly. This corroborates the remarks we made earlier about the questionable way in which LKK measured resources. Salience does not contribute to a better prediction. Comparing the results of Tables 1 and 2, it is remarkable, therefore, that voting power is able to correct the negative effect of resources completely. Furthermore, the magnitude of the predictions corresponds to a much greater extent with the controversiality of the issues than on the basis of access alone. Once again, it shows how important the correct representation of the institutional settings is in our two-stage model. Our preliminary conclusion from this first empirical comparison of alternative models is, therefore, that access and voting power are the most important components of our model and that the contributions of resources and salience have to be demonstated in further research. On the basis of these results, we claim to have successfully modeled the central elements of the decision-making process.

Positional Power in the U.S. Energy-Policy Domain and the State-Autonomy Debate

In the light of the above results, we feel justified in applying our two-stage model to the debate on state autonomy. Our quantitative approach makes it possible to view this debate in a new light. Using our structural model—which is defined by Equation (15) and for which the components have been measured in the manner described earlier—we can derive the positionally most powerful organizations in the U.S. energy-policy domain (see Table 3).

Table 3. The Top 20 Organizations in the United States' Energy-Policy Domain

			Control Based on Access and Resources	
	Actor Type	*Positional Power*	*Network Control*	*Rank Order*
1. The White House Office	FA	1.021	163.9	1
2. Democratic House Subcommittee on Energy and Power	CS	0.188	51.1	17
3. Democratic House Subcommittee on Energy and Environment	CS	0.155	48.2	20
4. Democratic House Subcommittee on Oversight and Investigaion	CS	0.150	23.0	62
5. Office of Management and the Budget	FA	0.127	146.4	2
6. Democratic Senate Subcommittee on Energy Conservation and Supply	CS	0.099	15.4	84
7. Department of Energy	FA	0.095	86.9	6
8. Republican House Subcommittee on Energy and Power	CS	0.093	39.2	31
9. Republican Senate Subcommittee on Energy Conservation and Supply	CS	0.063	33.6	35
10. Edison Electric Institute	TA	0.063	112.8	4
11. American Petroleum Institute	TA	0.059	119.3	3
12. Environmental Policy Center	PI	0.053	93.4	5
13. Westinghouse Electric Corporation	BC	0.052	56.8	12
14. Office of Science and Technology	FA	0.052	10.5	109
15. Environmental Protection Agency	FA	0.043	64.3	9
16. National Rural Electric Cooperative Association	TA	0.042	52.4	16
17. National Association of Manufacturers	TA	0.041	83.2	7
18. Gulf Oil Company	BC	0.041	63.5	10
19. Federal Energy Regulatory Commission	FA	0.039	21.4	67
20. Council on Environmental Quality	FA	0.037	24.1	59

An inspection of Table 3 quickly leads to the conclusion that public actors are positionally the most powerful organizations in the U.S. energy-policy domain: the overwhelming majority of power rests with public actors—13 of the top 20 organizations belong to this category. Given the fact that these are the actors that take the actual decisions, this is not especially remarkable. The scores of the White House Office, the Office of Management and the Budget, the Department of Energy, and the Democratic Congressional actors do, however, show how great their impact is on the process. Even the most influential trade associations and public-interest groups—the American

Petroleum Institute, the Edison Electric Institute, and the Environmental Policy Center—play only a secondary role when voting power is taken into account.

Another important conclusion from Table 3 is that the White House Office, the Office of Management and the Budget, and the Department of Energy are not only powerful in terms of voting power. They are also key organizations in the network of candid/confidential exchanges between the organizations in the policy domain. The positions taken by the White House Office and the Office of Management and the Budget are especially important, as they influence more than any other public or private actor the positions of other actors in the domain. When the centrality of these key actors in the network is combined with their great voting power, we can only conclude that the impact of the three most powerful actors in the domain does not confine itself to a single stage of the policymaking process.

That the stage of decision taking is the most crucial in the determination of positional power is, however, illustrated in Table 4. The table compares the 20 most powerful actors when different combinations of components are taken into account in the definition of the policy network. In the step where the voting-power component is incorporated into the structural equation (column 3 of the table), the greatest shift takes place. In later steps, no further changes occur.

As a result of the above analysis, we conclude that state organizations have a crucial impact on the formulation of policy. This conclusion is, however, not disputed. As pointed out earlier, instrumentalists do not maintain that state organizations are unimportant, only that they are instruments at the service of other entities. What is crucial in the debate regarding state autonomy is not so much the impact of state organizations as the degree to which they themselves determine the end to which their impact is directed. To illustrate this point, let us return to the policy positions of the White House Office following the influencing of other actors (see Table 1). In four of the eight cases, we compute an opposite position taken by the White House Office after a single influence round, and in one case this position again reverses in the second round. This might lead us to conclude that state organizations are indeed predominantly instruments in the hands of societal actors. We, however, stress that these four cases represent the most controversial events analyzed and that our deduced position is not the consequence of a successful ruling-class strategy, but the result of a multitude of contradictory influence attempts. Such a transformation, however, does not only occur in the case of the White House Office, but applies—as result of the manner in which our model has been developed and empirically operationalized—equally to all actors in the domain. In addition, being the most central actor in the network, the White House Office itself exerts the greatest influence and can therefore have a large own-impact on the process.

Table 4. Distribution of the Top 20 Organizations by Actor Type After Consecutive Steps of the Overall Power Model

Actor Type	*Total Population*	*(1) Access*	*(2) Access x Resources*	*(3) Total EDP*[a]	*(4) Direct Power*	*(5) Positional Power*	*(6) Exercised Control*[b]
FA	21	3	4	7	7	7	3
CS	20	5	2	6	6	6	2
TA	47	4	7	4	4	4	4
BC	64	7	5	2	2	2	9
PI	21	1	2	1	1	1	1
LU	5	—	—	—	—	—	1
GA	8	—	—	—	—	—	—
RU	4	—	—	—	—	—	—
PS	2	—	—	—	—	—	—
Newly added component		A	R	V	S	P	

Notes: [a] By summing the ($CV + V$) scores of all organizations over all analyzed events, the total event-determination potential (*EDP*) can be computed. This represents the combined potential impact that each individual organization can exert during one influence round in all the events that comprise the system.

[b] The results presented here have been calculated on the basis of Table 13.3: *Exercised Control Over the Outcome of Events in Energy and Health Domains by Organizational Types and Issue Publics* (LKK 1987, pp. 360-361), by summing control over all eight events and assuming that the various actor types are proportionately distributed over the top 20 organizations in all eight events. Their analysis is based upon 128 instead of 192 organizations: 12 FA, 10 CS, 24 TA, 51 BC, 15 PI, 5 LU, 9 GA, 1 RU, and 1 PS—only those organizations that had indicated interest in at least one of the eight events.

In summary, our first empirical test of the two-stage model appears to emphasize the great impact of state structures on policymaking. Caution is needed in interpreting a first empirical test. We are, however, convinced that the first results are substantive and feel confident in letting our results speak for themselves.

CONCLUDING REMARKS

In the above sections, a two-stage model of policymaking has been elaborated and submitted to a first empirical test. The model enables us to compute an overall power vector for all actors on the basis of which their powers in the system can be compared, notwithstanding different power and influence mechanisms the actors have at hand. This novelty is combined with the ability to predict outcomes of decisions as an empirical test of the right specifications of the model.

This first empirical test of our model was somewhat constrained by the limitations of the data that were gathered without the two-stage model in mind or at hand. Nevertheless the two-stage model arrives at only one truly incorrect prediction in eight selected scenarios and, in this respect, rivals the models used by LKK.

The question arises in what manner our approach is superior to that of LKK, as they arrived at the same predictions. The major distinction between our two-stage model and their models is the explicit inclusion of the decision-taking phase in the political process in our model, and the resulting recognition that processes in which power is exercised by actors are completely different in the influence phase from those in the actual decision-taking phase. Our criticism of the manner in which they have modeled the policymaking process and estimated their model components was described in the section on previous models. We believe that they overwhelmingly concentrated in their analyses on the access component—albeit weighted to take salience and power into account—as their predictions seem to correspond to a great extent with our model predictions based on access alone (see Table 4).

The great contribution of LKK's approach lies in its empirical illustration of how open U.S. national policymaking in general, and the U.S. energy-policy domain in the late 1970s in particular, is. They describe this specific domain in the 1970s to have been "in the throes of a rapid move from a highly decentralized and privatized past toward a more centralized structure of decision making" (p. 189). With regard to the United States, many researchers have observed the organizational decentralization of the private sector, the easy access of business groups and large corporations to Congressional representatives, and the fragmentation and weakness of the American federal state structure (Katzenstein 1978; Schneider 1985; Wilson 1982; Zysman 1983).

> There is no institutional way to regulate the access of interest groups to decision-makers in the United States. ... Federalism, the separation of powers, the fragmentation of power with both Congress and the executive, and the absence of a strong system of party discipline combine to create a multiplicity of channels of access for the accepted interest group which it is impossible to control (Wilson 1982, p. 225).

How well, however, will the LKK models function in empirically more corporatist situations outside the United States? In our opinion, a formal model of decision making that cannot take into account the differences in institutional structure in different policymaking situations, has only a limited applicability. Our two-stage model does, however, have the capacity to take these aspects of policymaking also into account, as we have illustrated several times.

Although the possibilities of deriving shifts of policy positions of public actors and predictions of outcomes of decisions may be seen as the most important functional derivatives of the structural model, a few other important functional aspects may at present be mentioned. They, however, still require further elaboration. The similarity of C on the one hand and (VS) on the other can be used as an indicator of institutional stress and the tendency for institutional change. This similarity indicates whether significant actors have control over public actors who decide on issues in which they are interested. In a like manner, the similarity of (CV) and S can also give interesting insights into the political system, because this similarity indicates whether private actors have control over collective decisions in which they are interested.

That institutional structures count, we believe to have shown. Only when the model has been further developed and rigorously tested in "closed" policy domains will it become possible to reach a more definite conclusion as to the contribution of the two-stage model to policymaking research.

APPENDIX

Synopsis of the Collective Decision-Making Process in the Eight Selected Events of the U.S. Energy-Policy Domain

CRBR: First authorized in 1970, the *Clinch River Breeder Reactor* was a demonstration project for a new nuclear technology. During the Carter administration, however, the President repeatedly vetoed appropriations for the project. In April 1979, the House Science Committee set the stage for another confrontation. Rejecting the Carter administration proposal to amend the Energy Department authorization by removing any commitment to the financing of such demonstration projects, the committee voted to continue funding the Clinch River reactor.

NWS: Faced with considerable political opposition to the development of geologically stable, permanent depositories for *nuclear waste,* in December

1979 the Senate Energy Committee reported a bill requiring the Energy Secretary to establish long-term interim *storage* facilities above ground.

EMB: As part of his second national energy plan, Carter proposed the creation of an *Energy Mobilization Board* to facilitate energy-development projects, even at the cost of overriding state laws and environmental regulations. In August 1979, two House committees reported bills creating such an agency and the Senate passed related legislation that autumn. Eventually, a coalition of liberal Democrats and states-rights Republicans in the House defeated the conference bill.

NGD: Following a year of intense disagreement, in August 1978 a House-Senate conference committee reported compromise legislation providing for the *deregulation of natural gas* pricing. The bill was approved by Congress and signed into law that November.

NPCM: In May 1979, prompted by growing criticism of the nuclear regulatory system and the accident at Three Mile Island, the Subcommittee on Energy and Environment passed an amendment calling for a six-month *moratorium on nuclear plant construction.* This was passed by the full committee, but defeated by the House in November 1979.

TWP: In April 1979, Carter announced the gradual decontrol of oil prices and asked Congress to approve a *tax* on resulting *windfall profits.* Two months later, the House Ways and Means Committee reported a bill taxing profits from deregulated *oil and gas.* Congress approved amended legislation in March 1980.

SMCP: The Surface Mining Control and Reclamation Act of 1977 imposed strict federal regulations on the mining industry. In July 1979, the Senate Energy Committee reported a bill allowing states to develop their own *strip mining regulations* independent of federal law. The legislation was approved by the Senate but was allowed to die in the House and, in the following year, in conference.

SGRP: Without making a recommendation, in April 1979 the House Commerce Committee reported legislation proposed by the Carter administration for *standby rationing of gasoline.* In an amended form, this legislation was approved by the Senate but was killed in the House.[7]

ACKNOWLEDGMENTS

The initial elaboration of the model took place during the period that the first author was Visiting Professor in 1987/88 at the University of Michigan; it was first presented at the Ann Arbor *Conference on World Politics* (Stokman and Van den Bos 1988). Our special appreciation goes to Frans Wasseur, Peter Van Roozendaal, and Reinier Van Oosten, who made it possible to empirically test the model: the first two by conducting the many time-consuming analyses of the complex network, and the last one by implementing the model in an object-oriented environment so that repeated

analyses of modified versions became feasible (Stokman and Van Oosten 1990). In addition, we wish to thank Ed Laumann and David Knoke for making their data available to us, and David Knoke for his comments on an earlier version of this paper. Finally, we are grateful for the comments made by ICS faculty. The empirical analysis has been conducted with the relational database program INGRES and the social network program GRADAP (Sprenger and Stokman 1989) and SMALLTALK-80. The computer implementation of the model was supported by IBM in the framework of a study contract between IBM and ICS.

NOTES

1. The power of an actor can then directly be defined as his or her control over decisions that are salient to powerful actors:

$$p^{(2)}{}_i = \sum_{j=1}^{N} \sum_{k=1}^{K} v_{ik} \cdot s_{kj} \cdot p^{(2)}{}_j \qquad (4a)$$

2. According to this definition, the voting powers of actors vary from .5 for all actors without voting power to 1 for a dictator. For computational reasons, it is recommended to rescale the voting powers to the interval from 0 to 1, resulting in a voting power of 0 for all actors without voting power.

3. This extension was developed by Tom Snijders (ICS) who is also the author of a Pascal program to compute the voting power measure. In the program, up to five dimensions can be specified. The program is available on request.

4. For the computation of the vector P it may be necessary to normalize the matrix ($CVS + VS$) in order to ensure that its inverse exists.

5. Two of the types of resources defined in *The Organizational State* and analyzed extensively in other chapters of the book—but no in their power models in Chapter 13—do not correspond with our definition of resources. As defined in our model, we believe in that "good connections to influential organizations" is an element of access, whereas "official desicion-making authority" is nothing but a synonym for our voting-power element. We have therefore excluded these elements from our operationalization of resources.

6. After personal consultation with Laumann and Knoke, we have come to the conclusion that in *The Organizational State* the prediction of the outcome of the EMB is incorrect as the direction of the event was mistakenly reversed. LKK consider the actual outcome of the SMCP as positive. They agree that it should be negative when the outcome of Congress is taken as yardstick.

7. The source for this synopsis is LKK's Table 13.1 (1987, pp. 353-354).

REFERENCES

Bachrach, Peter and Morton S. Baratz. 1970. *Power and Poverty: Theory and Practice*. New York: Oxford University Press.

Bueno de Mesquita, Bruce, David Newman, and Alvin Rabushka. 1985. *Forecasting Political Events: The Future of Hong Kong*. New Haven and London: Yale University Press.

Bonacich, Phil. 1972. "Factoring and Weighting Approaches to Status Scores and Clique Identification." *Journal of Mathematical Scoiology* 2: 113-120.

Burt, Ronald S. 1980. "Models of Network Structure." *Annual Review of Sociology* 6: 70-141.

Cawson, Alan. 1985. "Introduction. Varieties of Corporatism: the Importance of the Meso-Level of Interest Mediation." Pp. 1-21 in *Organized Interests and the State: Studies in Meso-Corporatism,* edited by Alan Cawson. London and Beverly Hills, CA: Sage Publications.

Coleman, James S. 1972. "Systems of Social Exchange." *Journal of Mathematical Sociology* 2: 145-163.

Coleman, James S. 1973. *The Mathematics of Collective Action.* London: Heinemann Educational Books.

Coleman, James S. 1982. *The Asymmetric Society.* Syracuse, NY: Syracuse University Press.

Coleman, James S. 1990. *Foundations of Social Theory.* Cambridge, MA: Belknap Press of the Harvard University Press.

Congressional Quarterly, Inc. 1981. *Congress and the Nation. A Review of Government and Politics,* Vol. V, 1977-1980. Washington, DC: Congressional Quarterly, Inc.

Dahl, Robert A. 1958. "A Critique of the Ruling Elite Model." *American Political Science Review* 52: 463-469.

Dahl, Robert A. 1961. *Who Governs? Democracy and Power in an American City.* New Haven, CT: Yale University Press.

Domhoff, G. William. 1970. *The Higher Circles.* New York: Random House.

Domhoff, G. William. 1979. *The Powers That Be: Processes of Ruling Class Domination in America.* New York: Random House.

Domhoff, G. William. 1983. *Who Rules America Now?* Englewood Cliffs, NJ: Prentice-Hall.

French, John R. P., Jr. 1956. "A Formal Theory of Social Power." *Psychological Review* 63: 181-194.

Hall, Richard L. 1987. "Participation and Purpose in Committee Decision Making." *American Political Science Review* 81: 105-127.

Hanf, Kenneth and Fritz W. Scharpf (eds.). 1977. *Interorganizational Policy Making: Limits to Coordination and Central Control.* London: Sage Publications.

Heclo, Hugh. 1978. "Issue Networks and the Executive Establishment." Pp. 87-124 in *The New American Political System,* edited by A. King. Washington, DC: American Enterprise Institute.

Hoede, C. 1978. *A New Status Score for Actors in a Social Network.* Twente, The Netherlands: University of Twente.

Hoede, C. and R. R. Bakker. 1982. "A Theory of Decisional Power." *Journal of Mathematical Sociology* 8: 309-322.

Hoede, C. and A. Meek. 1983. "Structural Aspects of Decisional Power." *Journal of Mathematical Sociology* 9: 242-252.

Hoede, C. and J. S. Redfern. 1985. "Optimization of Decisional Power in Representational Systems with Voting Power." *Journal of Mathematical Sociology* 11: 331-340.

Hubbell, C. H. 1965. "An Input-Output Approach to Clique Identification." *Sociometry* 28: 377-399.

Katz, Leo. 1953. "A New Status Index Derived from Sociometric Data Analysis." *Psychometrika* 18: 39-43.

Katzenstein, Peter J. 1978. "Introduction: Domestic and International Forces and Strategies of Foreign Economic Policy." and "Conclusion: Domestic Structures and Strategies of Foreign Economic Policy." Pp. 3-22 and 295-336 in *Between Power and Plenty,* edited by Peter J. Katzenstein. London and Madison, WI: University of Wisconsin Press.

Katzenstein, Peter J. 1985. *Small States in World Markets: Industrial Policy in Europe.* London and Ithaca, NY: Cornell University Press.

Katzenstein, Peter J. 1987. *Policy and Politics in West Germany: The Growth of a Semisovereign State.* Philadelphia, PA: Temple University Press.

Kenis, Patrick and Volker Schneider. 1989. "Policy Networks as an Analytical Tool for Policy Analysis: A Review and Some Applications." Unpublished manuscript, Max-Planck-Institute, Cologne.

Kolko, Gabriel. 1962. *Wealth and Power in America.* New York: Praeger.

Laumann, Edward O. and David Knoke. 1987. *The Organizational State: Social Choice in National Policy Domains.* Madison: University of Wisconsin Press.

Laumann, Edward O., David Knoke, and Yong-Hak Kim. 1987. "Event Outcomes." Pp. 343-373 in *The Organizational State: Social Choice in National Policy Domains,* by E.O. Laumann and D. Knoke. Madison: University of Wisconsin Press.

Lehmbruch, Gerhard. 1982. "Introduction: Neo-Corporatism in Comparative Perspective." Pp. 1-28 in *Patterns of Corporatist Policy-Making,* edited by Gerhard Lehmbruch and Philippe C. Schmitter. London and Beverly Hills, CA: Sage Publications.

Miliband, Ralph. 1969. *The State in Capitalist Society: The Analysis of the Western System of Power.* Aylesbury: Hunt Barnard Printing.

Mokken, Robert J. and Frans N. Stokman. 1976. "Power and Influence as Political Phenomena." Pp. 33-54 in *Power and Political Theory. Some European Perspectives,* edited by B. Barry. London: John Wiley.

Orloff, Ann Shola and Theda Skocpol. 1984. "Why Not Equal Protection? Explaining the Politics of Public Social Spending in Britain, 1900-1911, and the United States, 1880s-1920." *American Sociological Review* 49: 726-750.

Poulantzas, Nicos. 1978. *State, Power, Socialism.* London: NLB.

Quadagno, Jill S. 1984. "Welfare Capitalism and the Social Security Act of 1935." *American Sociological Review* 49: 632-647.

Quadagno. Jill S. 1985. "Two Models of Welfare State Development: Reply to Skocpol and Amenta." *American Sociological Review* 50: 575-578.

Schmitter, Philippe C. 1982. "Reflections on Where the Theory of Neo-Corporatism Has Gone and Where the Praxis of Neo-Corporatism May Be Going." Pp. 259-279 in *Patterns of Corporatist Policy-Making,* edited by Gerhard Lehmbruch and Philippe C. Schmitter. London and Beverly Hills, CA: Sage Publications.

Schneider, Volker. 1985. "Corporatist and Pluralist Patterns of Policy-Making for Chemicals Control: A Comparison Between West Germany and the USA." Pp. 174-191 in *Organized Interests and the State. Studies in Meso-Corporatism,* edited by Alan Cawson. London and Beverly Hills, CA: Sage Publications.

Skocpol, Theda and Edwin Amenta. 1985. "Did Capitalists Shape Social Security?" *American Sociological Review* 50: 572-575.

Sprenger, C. and Frans N. Stokman. 1989. *GRADAP. Graph Definition and Analysis Package User's Manual.* Groningen, The Netherlands: IEC-ProGAMMA.

Stokman, Frans N. and Jan M. M. Van den Bos. 1988. *A General Model of Policy Making and its Application to Dutch EC-Policy.* Groningen/Utrecht, The Netherlands: ICS Prepublications.

Stokman, Frans N. and Reinier Van Oosten. 1990. *A Dynamic Model of Policy Networks.* Unpublished manuscript, University of Groningen.

Taylor, Michael. 1969. "Influence Structures." *Sociometry* 32: 490-502.

Wilson, Graham K. 1982. "Why Is There No Corporatism in the United States?" Pp. 219-236 in *Patterns of Corporatist Policy-Making,* edited by Gerhard Lehmbruch and Philippe C. Schmitter. London and Beverly Hills, CA: Sage Publications.

Zysman, John. 1983. *Governments, Markets, and Growth: Financial Systems and the Politics of Industrial Change.* Oxford: Martin Robertson.